THE ADOPTION OF COMPUTATIONAL OBJECTIVES TO PRODUCE IMPORTANT ADVANCES IN MODERN LINGUISTICS

KEYWORDS: Linguistics, Computational Linguistics, NLP, Teaching, Learning Languages.

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Abstract

It is safe to say that the linguistics revolution has begun and the revolution is being computerized. It is no amplification to say that linguistics has undergone a renaissance with the rapid development of computers and the internet that are witnessing in the modern era through the spread and tremendous changes brought about by digital technology through computing, which marked the beginning of an information age. For the time being, the field of computational linguistics straddles linguistics and computer science with the help of psychology and logic by using computers to simplify the handling of linguistic issues. It is considered as a branch of computer science and linguistics. However, it is built on the collaboration between computer science and linguistics. Every aspect of linguistics has been affected by the application of this technology. The aim of this review is to focus on the field of computational linguistics and its skills by focusing on linguistics with reference to the uses of computers in relation to teaching and the role of teachers today towards students in the modern era through the digital revolution.

1. Introduction

Since the advent of the computer in the late 1940s, its connection with language has been documented and rooted. Language is at the top of the subjects of human sciences (Grishman, 1986). In particular, the development of our understanding of natural language processing has achieved hitherto unimagined levels of mastery regarding natural language processing. Far more than a theoretical exploration, a new level of applied linguistics now ushers every aspect of linguistic knowledge to the task of processing and learning languages. Computer is the pinnacle of modern technologies, so it was logical and even inevitable that the language and the computer should meet, for a basic and simple reason, which is that the language is an embodiment of human mental activity at the same time that the computer tends to simulate some human functions and mental capabilities, including language in its levels (Phonetics and Phonology, and Morphology, Syntax, and Lexicon) in addition to other usage

levels (Clark et al., 2010; Grishman, 1986; Mitkov, 2022). Computational linguistics began in 1949 in translation to occupy a large part of the interest of those working in the field of linguistics and computer software at the same time, because the revolution of digital communication has reached remote places in this world and languages are one of the fields affected by that revolution through the multiplicity of applications of computational linguistics and its multiplicity of uses (Clark et al., 2010; Grishman, 1986). This is what made it a focus of attention by prominent researchers and specialists, but it came as a result of the results of separate efforts, which made it difficult to put a specific chronological date for this science, but despite that it passed through different periods of time and many countries. It is a science that brings together two sciences that may seem far apart, namely linguistics and computer science (Mitkov, 2022). Before moving deeper talking about computational linguistics, I think it is necessary to give a simple idea about linguistics, or what is known as linguistics.

The renaissance of computational linguistics through the implementation of various technologies that characterize the computer is a qualitative leap in order to improve the level of knowledge in educational systems in their various stages. It is a science concerned with language, as it searches for human language as a natural tool for its features, which centers the principles of this science from general linguistics in all its analytical levels: phonological, grammatical, and semantic, and from the science of electronic computers, and from the science of artificial intelligence, and the science of logic, and then the science of mathematics where these branches harmonize and combine to form the principles of instrumental linguistics (Clark et al., 2010; Grishman, 1986). This opens spaces for creativity and discovery of other languages through machine translation, which relies mainly on various electronic dictionaries, whether bilingual or multilingual (Clark et al., 2010; Grishman, 1986). This technology, which works to provide practical solutions to various complex linguistic issues in the education process, would also contribute to teaching various language skills (Clark et al., 2010). As it is considered an advanced way

to deliver information to researchers, and it is the method adopted by various educational systems in developed countries. As mentioned by Kay (2003) there have been two main motivations behind the activities of computational linguistics: 1. It came from thinking that the adoption of computational goals would cause important advances in linguistics. 2. It came from a desire to produce technology to serve the practical needs of translation, information extraction, and grammar checking. It is clear that computational linguistics, as a field, precedes artificial intelligence, and it is the field under which it often falls. Computational linguistics arose with efforts in the United States in the 1950s to use computers to automatically translate texts from foreign languages, particularly Russian scholarly journals, into English (Kay, 2003). Since computers can perform mathematical calculations faster and more accurately than humans (Kay, 2003). It was thought that it was only a matter of a short time before the attention paid to technical detail that would allow them the same remarkable ability to process language.

Language is the clearest and most distinguishing characteristic of human being among all creatures, and it is not just a system that generates sounds, which in turn convey meaning, but language is a mirror of the human mind, and a container of knowledge (Sinha, 2005). A new science appeared at the beginning of the twentieth century, which is modern linguistics that was translated into several terms, for instance, into Arabic language (Sinha, 2005). It is a science that searches for formal and logical formulations that describe and interpret language. This new science flourished in the middle of the century at the hands of the famous linguist Noam Chomsky, who presented his famous theory Generative-Transformational Theory (Clark et al., 2010; Sinha, 2005). Through his theory, he answered a set of questions about language, its origin, and its relationship to thought, for the purpose of knowing the system and nature of the human mind, as these aspects were excluded from the linguistic study of many linguistic schools, especially the structural and behavioral school. Chomsky's studies opened up new areas and fields of knowledge, such as the

relationship of language to mathematics, semantics, biology and psychology, to the extent that he considered linguistics a branch of cognitive psychology (Saumjan, 1971). Chomsky has enabled linguists to find different and diverse theories and methods in formulating language formally, through his famous theory in which an atypical formulation of language is based on simple formal and logical relationships (Saumjan, 1971). This theory was a prelude to using these formulations in designing computer systems that deal with human language. Where specialists in computer science benefited from the formal formulations of the language developed by linguists for computer application, the existence of the mathematical formal formulation is a condition for building computer applications.

At that time, a new science called "computational linguistics" was introduced. It is viewed as including the study of the computational aspects of language and the common problems facing the computer processing of language in its written or spoken form (Clark et al., 2010). Computational linguistics is also defined as the science of studying computer systems with the aim of understanding, generating and analyzing natural languages (Clark et al., 2010).

So, computational linguistics is a special science that is the result of advanced technological developments. It is also an accurate science that displays the latest theories and computer applications (Grishman, 1986). In which the theoretical linguistic aspect meets with all its cognitive and methodological backgrounds with the information technology aspect with all its developments to formulate for us computational linguistics or what is computational linguistics, as it is a new science that needs experts from both sides to root for it (Mitkov, 2022).

There is no doubt that there is a great connection between natural languages and modern technology. Since the human brain is equipped with an innate divine system that stores language and retrieves it when necessary, the human linguistic system is built in the form of a computer with inputs and outputs—stored in the form of algorithms and formal arithmetic laws

(Grishman, 1986; Mitkov, 2022; Sinha, 2005; Clark et al., 2010). As for the output stage, the process of generating inputs and linguistic structures takes place indefinitely, as they are presented to the algorithm after analyzing them in preparation for the communication process.

Computing natural language processing is not an easy matter, but rather requires a lot of effort and requires specialized research teams with a complete computer and linguistic vision (Mitkov, 2022). Most of the systems and programs tested on human languages have not been spared so far from many problems and difficulties, whether at the methodological or visual level of the language (Mitkov, 2022). The researcher in computational linguistics needs to be armed with linguistic theoretical foundations, with the need to understand technical aspects that light the way for him in front of description and comparison in order to reach the correct and most realistic approach in describing the particles of linguistic discourse (Mitkov, 2022). In turn, it needs to adapt human languages to become a pliable tool in the hands of the computer and its algorithms.

Work in natural language computing requires mastery of two types of knowledge: accurate knowledge of all parts of the linguistic system according to the latest modern linguistic theories, roles, and knowledge of computer knowledge related to natural language processing, especially in its logical programming aspect (Clark et al., 2010). As a computer or machine is a software system logical based on a set of precise algorithms (Clark et al., 2010; Grishman, 1986; Mitkov, 2022; Sinha, 2005). It cannot progress in the field of research in linguistic computing until combine these two types of knowledge.

The idea of linking language and technology began in the mid-1950s and early 1960s, when scientists began to develop programs for machine translation, and scientists provided all their technological capabilities to serve this delicate and virgin research field (Grishman, 1986; Mitkov, 2022; Sinha, 2005). Scientists' research focused on building programming languages, developing algorithms, and artificial intelligence. These fields intersected in their own way

with general linguistics and its way of dealing with the structure of natural languages (Mitkov, 2022). It turned out later that linguistics employs the same tools used in machine translation in processing language, which in turn was the common theme between them (Clark et al., 2010; Mitkov, 2022).

After a while, what is known today as computational linguistics was established; Where experts designed synthetic analyzers and generators, many synthetic formal rules were built for this purpose, and linguistic algorithms were developed, all of which led to the development of scientific theories within the framework of cosmputational linguistics (Clark et al., 2010). This new field has evolved into another name, language technology or linguistic engineering.

Herein, it is necessary to recognize what the main purpose of this science, the goal is to write programs that can handle as much language material as possible. These programs are good but approximate solutions (Grishman, 1986; Clark et al., 2010). It cannot handle all sentences in natural language, although it does handle the most common and interesting structures. This fact, which is generally accepted by computational linguists, would be unacceptable to theoretical linguists, because it is part of their goal for their grammatical theory to explain all sentences of a language that are grammatically correct. In this regard, Grishman (1986) specified that work in theoretical linguistics is relevant to computational linguistics, because all generalization efforts, for example, by reducing a large set of sentences to a small set of rules and the constraints of those rules that have previously been made to describe the grammar of a given natural language are necessary for computational linguistics, especially in the process of sentence analysis.

The task of building systems that understand or generate natural language is a complex one. It requires the integration of many types of linguistic (morphological, syntactic, and semantic) and non-linguistic (discourse domain knowledge) data (Grishman, 1986; Mitkov, 2022; Sinha, 2005; Clark et al., 2010). It also requires the efficient use of all data. In this sense, designing and building natural language applications is an engineering task. One general

strategy for making construction functions easier is division, such as, breaking down a problem into smaller sub-problems. This concept is not alien to linguistics. Linguistic ability is usually represented and studied as operating at structural levels: sounds, words, and sentences. Linguists study the phonetics, phonology, morphology, semantics, and structure of language and postulate the existence of levels or modules in human capacity, for example, Chomsky's principle of independent syntax, the study of sentence structures (Saumjan, 1971; Clark et al., 2010). Even if the normative view is a simplification of linguistic ability, it makes natural language systems flexible and easy to extend. The amount of knowledge used in the comprehension or generation process depends on the purpose of the application. For many applications, the primary task is sentence parsing, such as, determining what sentences mean. Some applications also require the analysis of supra-sentence units, such as discourse and dialogue.

2. Research design and method

It is a review that deals with the growth of computational linguistics and the motives for its existence in the modern era, in addition to its theoretical and applied components that show its relationship to understanding natural language, the advantages that are used to process natural language. It also deals with some of the most important applications, with reference to its influential role in teaching and learning processes and problems.

3. Computer-aided Language Learning (CALL)

Computer-assisted language learning or CALL is a method of teaching and learning that has been in use for more than forty years. Typical CAL programs present a stimulus to which the learner must respond (Levy, 1997). The stimulus can be presented in any combination of text, still images, audio, and video. The learner responds by typing on the keyboard, pointing and clicking the mouse, or speaking into a microphone, and the computer provides the response indicating whether the learner's response is correct or incorrect

(Lee, 2000; Levy, 1997). These programs can be obtained on CD-ROM or online. Computer-aided language learning (CALL) is a powerful example of the way linguistics has bridged the gap between the scholarly study of language in all its aspects, from vocabulary, to pronunciation, from syntax to semantics, from pragmatics to morphology, the use of CALL has revolutionized linguistics (Lee, 2000; Levy, 1997). The ultimate implementation of this new world of applied linguistics is represented by the sudden worldwide adoption of the World Wide Web. The internet allows CALL to enter scholarship, and pedagogy with an adroitness and joy that has not been previously experienced, for example, in foreign language classrooms.

Lee (2000) divided the period of using computer-assisted language learning into three stages, where each stage shows the level of technology and educational theories of its era: (a) The Behaviourist Call phase, which first began in the sixties and seventies and relied mainly on linguistic repetition exercises, (b) The communicative call phase, which originated in the 1970s and 1980s, focused on generating original words rather than the old methods using repetition exercises, (c) The Integrative Call stage is the last stage that moved away from the cognitive view of communicative language teaching and approached from a socio-cognitive viewpoint in which an emphasis on a real meaningful context for realistic language use is emphasized. This stage also emphasizes the integration of the four skills of language learning (listening, speaking, writing and reading) and the integration of technology.

Today, it is widely accepted that everyone must be technologically literate, and this has resulted in computers and the internet becoming an in expendable appendage to linguists, teachers, and students alike. The internet is routinely and commonly used for ‘almost everything’ including to perform searches for information, communicate with family and friends, conducting business negotiations, banking transactions, professional consultations, to buy all kinds of items and as a form of entertainment. Thus, the growing popularity of new technologies has led to its use in the field of linguistics and education for

what has been referred to as e-learning or CALL. Every aspect of linguistics has been touched by this trend.

CALL originated in the last century, when the first mainframe computers were introduced in some universities. Levy (1997) a theorist, defined it as "the search and study of applications for teaching and learning of languages". For example, through the project PLATO (Programmed Logic for Automated Teaching Operations), initiated at the University of Illinois.

In 1960, thousands of computers around the world were networked for education, and this was a milestone in the first stage of CALL. However, except for that project, implementation was minimal until the 1980s. Over the past two decades, however, the picture has changed dramatically. Since the 1990s, according to Hubbard (2009) "the question is no longer whether to use the computer, but how." This usage extends from specific uses of computers in campus classes to completely virtual courses.

4. Creating New Subfields of Linguistics with Computers

In fact, CALL has itself become a proper subfield of linguistics - much more than a passing trend. CALL is now a linguistic field that investigates any use of computers in teaching and learning of second languages and foreign languages. Simons (2012: 3) goes so far as to consider it the new technology-based linguistics as a branch of science. It is multidisciplinary; it is influenced by disciplines such as linguistics, computer science, psychology, and pedagogy (Cangelosi and Parisi, 2012). Within CALL is another subfield that is evolving significantly known as Computer Assisted Language Testing (CALT). There are already numerous specialized journals and conferences dedicated to CALL and CALT. In this way, the twenty-first century has blossomed into a veritable Golden Age of applied linguistics.

Another subfield currently under development, though still with very limited use, is intelligent systems for computer-aided language learning (CALL). This areas studies and implements technologies for performing the role or function of a teacher in that it entails the identification of errors in the output

of the student, the offering of relevant feedback, the determination of the language level of fluency, the provision of appropriate materials and assignments for assisting students' progress, as well as interacting with students through conversation.

In other words, today the advent of CALL, CALT, are so pervasive and in expendable that suddenly it is nearly impossible to imagine teaching and learning language without computer assistance, either totally -in the case of virtual teaching or in part, as a support mechanism for traditional classroom teaching.

It may be argued that scholars of English, linguistics professors, and language teachers of all types are among the most committed to the implementation of computer technology to promote their work. In the fields of linguistics, education, and technology language teachers are typically on the forefront of relevant computer-assisted technologies.

5. Linguistic Resources and the Internet

Linguistics, applied linguistics, and teaching languages now boasts a new wealth of educational resources based on the world wide web, that encompasses materials and tools of various kinds. As far as materials are concerned, their wealth is overwhelming. On the one hand, one finds reference materials such as dictionaries, encyclopedias, manuals, etc. On the other hand, there are many materials prepared for various multimedia approaches to teaching: interactive exercises, audio, and video in different formats, text, images, from exercises and quizzes of all kinds, through texts and comics, to concept maps and vocabulary flash cards.

Lastly, new technologies allow virtually unlimited leverage by using authentic materials available online, especially when the level of students is low, including entertaining educational alternatives to traditional textbooks or exercises. These include fine-grained technological adjustments, for example, repeating audio tracks, slowing down audio tracks, subtitling, and even machine translation robots (Robin, 2007: 110-112).

6. The Linguistics Revolution Has Begun

Consider the word ‘podcast’. Unknown in 2004 by 99% of the population, in 2005 it was selected as the ‘word of the year' by the New Oxford American Dictionary (Cain, 2008: 10). These downloadable internet audio files with fixed periodicity have lent a new tactic to teachers of foreign languages. Indeed, the internet is already replete with web pages for dedicated language learning use by students and language teachers containing everything from actual recordings of language to prepared podcast lessons.

As for tools, the web offers a wide variety of functionalities that (a) create, manage and publish content, (b) enrich teaching and create teaching materials, (c) browse and search content for multimedia design and editing, (d) to enable office automation, and (e) to facilitate communication and collaboration on social networks. Two of the most popular tools are blogs and wikis.

A blog is a website that periodically updates articles collected chronologically from one or more authors, with the most recent appearing first. The author can allow other Internet users to make comments and always retains the right to post what is deemed appropriate. The possibilities are endless for implementing text and images, audio and video. Blog pedagogy is a growing subfield in academics.

A similar tool is the wiki. It is a collaborative web space, organized by a hypertext page structure in which users create, edit, delete, and modify the content asynchronously. The existence of numerous free of applications for creating wikis in different programming languages and various operating systems, has favored its development. Moreover, it is not necessary to master HTML5, the language in which web pages are coded, or to use a web page editor to collaborate on a wiki.

The language of the wikis eliminates non-essential elements of HTML and reduces participation to the essentials. Typical uses of wikis in linguistics and language education including appointment: (a) classroom communication

and collaboration spaces, (b) the assignment of dedicated learning spaces and filing tasks, (c) text archiving, (d) collaborative authorship projects between students, teachers, and both, and (d) the ability to enhance motivation and inspiration for learning due to the pleasurable venue and prospects for attaining significant audiences, and the list goes on.

7. Computerized Tools for Language Learning

The following software packages have each been researched and reviewed in scholarly publications.

JClic: a set of applications developed in Java 9 to make various types of activities: puzzles, associations, text exercises, and crossword activities are created and it also allows one to publish and display projects created to others (Guerrero, Muñoz, and Sotelino, 2007: 172-176).

Hot Potatoes: a system created by the University of Victoria, Canada, which allows the creation of six types of interactive exercises to perform online: multiple choice, fill voids, order, crosswords, matching and short answer (Soleimani and Raeesi, 2015: 1291-1295).

Builder: another tool for creating digital educational content promoting multiliteracies and multimodalities with 47 models of activities (Eteokleous, Pavlou, and Tsolakidis, 2015: 65-88).

MALTED (Multimedia Authoring Tutors for Language and Educational Development): allows creation of multimedia activities and courses for teaching languages by generating Java applets that may be executed later both on the computer's hard drive and through web sites in which they were published online (Bangs, 2003).

Squeak: one of many an open source applications to develop multimedia content without programming knowledge for making teaching units in text content, video, sound, music,

2D and 3D graphics, etc.; presentations include animations and all kinds of video and audio files. It is inspired by constructivist ideas in language learning

and has been endorsed by numerous educational institutions (Arslan, 2014: 158-165).

8. Discussion of the Findings

As it became clear from the above, computational linguistics is a scope that has been expanded to include many activities that serve computer users in general and those interested in language teaching and learning in particular. Computational linguistics serves two purposes. The first is teaching the language with computers through the Internet or CDs. The second is to develop programs that can benefit linguists, such as dictionaries, translation programs, and spelling and grammar checking. This cannot be dealt with by linguistics alone or by computer science alone, but there must be a close relationship between the two fields.

Despite the great advantages of computational linguistics, there are some obstacles. Among those obstacles as identified by Lee (2000), 1. Financial: It is considered the most important problem, especially in poor countries. Despite achieving higher results in less time, poor countries cannot provide their schools and universities with a sufficient number of computers to obtain the desired benefit. 2. Availability of computer hardware and software: Rapid changes in the technological power to choose the best quality of computer hardware and software. This is also difficult for poor countries. 3. Technical and theoretical knowledge: There is such a lack of technical knowledge that many trainers do not know how to use modern technology. In addition, many modern technology professional trainers rely mainly on technology and overlook systematic theoretical plans to integrate knowledge for their students, which may cause negative impact for both teachers and learners. 4. Acceptance of technology: Many trainers feel that new technology threatens their future because it requires preparation and constant communication with rapid change so that they feel that they are in a constant challenge that needs time and commitment. These obstacles can be addressed through developing teachers' attitudes towards the

use of computers in the educational process. It is significant to design training courses for teachers by opening a discussion with specialists to teach computational linguistics as an educational subject. In addition, providing computer labs for students of different levels in each major. Furthermore, it is necessary to choose an appropriate CDs for students of different levels to suit the integration of each level.

9. Conclusion

In short, the educational potential of CALL for teaching and learning languages is virtually endless. Such technologies allow for the practice of almost any all-language skill, to one extent or another. In fact, this is quickly becoming one of the most studied areas in linguistics and language learning research. According to Hubbard (2009: 10), the reason could be, on one hand, practical, since it is easy to gather data and one does not need to acquire or develop specific coding skills. Furthermore, this type of CALL communication is of great interest for the high degree of similarity it shares with naturally occurring language as a face-to-face type of interaction. For these reasons, scholars such as Vygotsky (1978: 34-41) and Ellis (2003) are achieving "a bridge between CALL technology and major learning theories, such as constructivism and cognitivism". The key is that CALL seems to work because the realistic negotiation of meaning actually occurs. Therefore, it is safe to say that the linguistics revolution has begun, and the revolution is being computerized.

اعتماد الأهداف الحاسوبية التي انتجت تقدما هاما في علم اللغة الحديث

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الملخص

من المؤمن ان نقول ان علم اللغة الحديث خضع الى ثورة العصر الرقمي التي نشهدها في العصر الحديث بواسطة الانتشار والتغيرات الهائلة التي جلبتها التكنلوجيا الرقمية بواسة الحوسبة التي شكلة بداية عصر معلوماتي. لقد تأثر كل جانب من جوانب اللغويات بتطبيق هذه التكنولوجيا الرقمية التي انتجة علم حديث اطلقو عليه علم اللغة الحاسوبي. وليس من المبالغة القول إن علم اللغة قد شهد نهضة مع التطور السريع لأجهزة الكمبيوتر والإنترنت. في الوقت الحالي ، يمتد مجال اللغويات الحاسوبية بين علم اللغة وعلوم الكمبيوتر بمساعدة علم النفس والمنطق باستخدام أجهزة الكمبيوتر لتبسيط التعامل مع القضايا اللغوية. علم اللغة الحاسوبي يعتبر فرعًا من علوم الكمبيوتر واللغويات، ومع ذلك ، فهو مبني على التعاون بين علوم الكمبيوتر واللغويات. الهدف من هذه المقالة هو التركيز على مجال اللغويات الحاسوبية ومهاراتها من خلال التركيز على علم اللغة مع الإشارة إلى استخدامات أجهزة الكمبيوتر فيما يتعلق بالتدريس ودور المعلمين اليوم تجاه طلاب في العصر الحديث الذي خضع الى الثورة الرقمية.

Reference List

Arslan, M. Oğuz. (2014). Free and Open Source Software as a Public Good: Implications for Education'. *European Journal of Research on Education*, no. 2(Special Issue), p. 158-165.

Bangs, P. (2003). 'Engaging the Learner - How to Author for Best Feedback'. In U. Felix (ed.), *Language Learning Online: Towards Best Practices*. Lisse: Swets & Zeitlinger Publishers.

Cain, R. (2008). Podcasting for Beginners. *TESOL-Spain Newsletter*, vol. 31, no. 3, p. 10-12.

Cangelosi, A., and Parisi, D. (2012). (eds.), *Simulating the Evolution of Language*. Springer Science & Business Media.

Clark, A. (Alexander S., Fox, C., & Lappin, S. (2010). *The handbook of computational linguistics and natural language processing*. https://books.google.iq/books?hl=en&lr=&id=6BJOwNHD1osC&oi=fnd&pg=PR9&dq=The+handbook+of+computational+linguistics+and+natur

al+language+processing&ots=eKjrODTwvr&sig=376oPPT4NBpNfum24ut5HcjVPLo&redir_esc=y#v=onepage&q=The%20handbook%20of%20computational%20linguistics%20and%20natural%20language%20processing&f=false.

Ellis, R. (2003). *Task-based Language Learning and Teaching*. Oxford University Press.

Eteokleous, N., Pavlou, V., and Tsolakidis, S. (2015). Integrating the Multimedia Builder Software as an Education Tool to Deliver Fairy Tales: Promoting Multiliteracies and Multimodality. *Journal of Interactive Learning Research*, vol. 26, no. 1, p. 65-88.

Grishman, R. (1986). *Computational Linguistics: An Introduction - Ralph Grishman - Google Books*. Cambridge University Press. https://books.google.iq/books?hl=en&lr=&id=Ar3-TXCYXUkC&oi=fnd&pg=PP8&dq=computational+linguistics&ots=3IH8GNZVSz&sig=56oLps2ZVBd_22KSJ6ylZnQe8C4&redir_esc=y#v=onepage&q=computational linguistics&f=false

Guerrero, E., Muñoz, A., and Sotelino, C. (2007). JClic: A New Software to Teach and Learn Easily. Implementation of Multimedia Activities in Our Classroom. *ICT in Education: Reflections and Perspectives*, June, p. 172-176.

Hubbard, P. (2009). (ed.), *Computer Assisted Language Learning: Critical Concepts in Linguistics. Present Trends and Future Directions in CALL*. Routledge.

Lee, K-W. (2000). English Teacher's Barrier to The Use of Computer-Assisted Language Learning. The Internet TESL Journal, VI (12). http://iteslj.org/Articles/Lee-CALLbarriers.html

Levy, M. (1997). *Computer-assisted Language Learning: Context and Conceptualization*. Oxford University Press.

Kay, M. (2003). *The Oxford Handbook of Computational Linguistics*. U.S.A. Oxford University Press.

Mitkov, R. (2022). *The Oxford Handbook of Computational Linguistics - Google Books*. Oxford University Press. https://books.google.iq/books?hl=en&lr=&id=CnpzEAAAQBAJ&oi=fnd&pg=PP1&dq=computational+linguistics&ots=33JC3EiKdc&sig=HnDOsBbTbfJNlHy1TqwgeWw1XZ0&redir_esc=y#v=onepage&q=computational linguistics&f=false

Robin, R. (2007). Commentary: Learner-based Listening and Technological Authenticity. *Language Learning & Technology*, vol. 11, no.1, p. 109-115.

Saumjan, S. K. (1971). *Principles of Structural Linguistics*. Mouton, The Hague - Paris. https://books.google.iq/books?id=-5NsDwAAQBAJ&pg=PA107&dq=Chomsky+has+enabled+linguists+to+find+different+and+diverse+theories+and+methods&hl=en&sa=X&ved=2ahUKEwjNysn_u9_7AhU6xQIHHWjCBjQQ6AF6BAgHEAI#v=onepage&q=Chomsky has enabled linguists to find differ

Sinha, M. P. (2005). *Modern Linguistics - M.P. Sinha - Google Books*. Atlantic Publishers & Distributors. https://books.google.iq/books?hl=en&lr=&id=v1JW1G6Td8UC&oi=fnd&pg=PA1&dq=modern+linguistics&ots=67LAgXvmbK&sig=fAR2ukhCE0heUyBVK9KQI2vdkB8&redir_esc=y#v=onepage&q=modern linguistics&f=false

Soleimani, H, and Raeesi, A. (2015). Hot Potatoes: The Merits and Demerits. *Theory and Practice in Language Studies*, vol. 5,.no. 6, p. 1291-129.

Vygotsky, L. (1978). Interaction between Learning and Development. *Readings on the Development of Children*, vol. 23, no. 3, p. 34-41.